Hitachi OPC Data Access Server

User Manual

v10

(applies to HitOPC version 1.4.0.0 and later)

General

OPC stands for "OLE for Process Control". It is a specification standardized by OPC foundation (www.opcfoundation.org) which enables OPC client applications to access hardware specific data via OPC servers in a common, well defined way.

Hitachi OPC Data Access Server enables OPC clients (SCADA/HMI or other) to connect to Hitachi PLCs, using task code protocol. Connection may be Ethernet or serial. OPC client may read or write any location from the complete PLC memory space.

Hitachi OPC Server may be installed on Microsoft Windows 2000, XP and Vista. Recommended operating system is MS Windows XP with the service pack 3.

Installation occupies approximately 1Mb of disk space. RAM usage depends on number of connected PLCs, number of clients, and number of monitored variables.

Activation Code

To use the Hitachi OPC Server, proper activation code should be entered. Activation code may be obtained from your Hitachi distributor.

According to application size, activation code may be:

- small up to 100 tags
- medium up to 1000 tags
- large unlimited number of tags

Using the OPC server with 10 or less tags is free, and no activation code is needed.

Without the activation code, or if the number of used tags is greater than number of tags allowed by the activation code, the OPC server will work two hours, then the warning message will pop up and the OPC server will stop. Period of two hours begins when the number of used tags becomes greater than allowed. Restarting the OPC server will provide another two hours. The number of restart cycles is not limited.

Without the activation code, OPC server may be used for development/test purpose only.

Configuration

Before connecting to a SCADA system, HitOPC Server should be properly configured. Each connected PLC should be listed in the configuration dialog, and all parameters should match corresponding PLCs.

Connection type may be Ethernet/UDP, Ethernet/TCP or Serial. Ethernet/UDP method is recommended because it is faster and allows more simultaneous connections to the same port. Disadvantage against TCP is unpredictable performance when requested data transfer rate is significant to or bigger than the bandwidth limit of the equipment.

Default LUMP number is FF FF 00 00, and it shouldn't be changed if the PLC is connected directly. If PLC is connected by using Hitachi link module, the proper LUMP number should be entered.

Ethernet connection

Ethernet is capable of only one TCP connection at the same time on the same port, so each TCP client should use different port number. UDP port may simultaneously serve more clients.

Retry timeout should be defined according to the expected network speed. Typical values are 200ms for a local network, and 2000ms for Internet connection.

Setting too large retry timeout will result in longer recovery time when a packet is lost. Setting too small retry timeout will result in collision of transmitted packets and dramatic loss of performances.

Timeout time applies if HitOPC server gets no answer from plc. In case of BUSY or any other error response, HitOPC server will resend request immediately, but respecting wait time (if defined).

Serial connection

To configure serial connection, the appropriate baud rate should be selected. If the baud rate of the connected PLC is unknown, autodetect option may be used, but it will cause a longer recovery time in case of communication errors.

Also the appropriate transmission control procedure should be selected. Transmission Control procedure 2 is a bit faster, but not all Hitachi CPU's supports it.

If more than one PLC is connected to the PC communication port, multidrop option should be selected, and station numbers should be defined. Station number should be unique for each PLC.

If connected PLC supports binary mode communication, the OPC server will use it automatically.

Actually used serial ports are marked with a small green rectangle.

General

"Show tray icon" - uncheck to disable taskbar access for unauthorized persons. Main HitOPC window may still be accessed by starting OPC manually.

"Allow browsing PLC variables" - most OPC clients support tag browsing function, allowing users to browse through the available address space. Although not allowed by the OPC rules, some clients on startup automatically browse the complete address space. In case of the Hitachi OPC, the address space is too big so the client stops responding for a very long time. To prevent this uncheck the "Allow browsing PLC variables" checkbox. Browsing will not be allowed, but the client should work properly.

"Autodetect intensive browsing clients" - if checked, OPC server detects such client (by counting browse events in specified time period), and automatically disables further browsing. On some very slow or busy PCs the autodetection may fail.

"Enable UNCERTAIN quality", "Enable BAD quality" - useful for testing purpose (for developing/testing SCADA system without real PLC connection available).

"Default number of array elements" - number of array elements to read, if client doesn't specify.

"Register Server", "Unregister Server" - HitOPC server is automatically registered by the setup procedure. If for any reason registration is lost, this command registers server to the Windows system without the need for reinstalling. Also useful for testing.

"Default" - set all options to default. Applies to the current tab only.

Block read

Block read options affect communication performance to Hitachi CPU, forcing a large number of smaller blocks, or a smaller number or bigger blocks. Smaller blocks waste more time for handshaking, but are also more optimal, wasting less bandwidth to transfer dummy locations. For example, if WM0000 and WM0002 are actually used, dummy location WM0001 may be also included, in order to transfer data within the single continous block.

In general, bigger blocks are more optimal to use with a high-speed connection (high-baud serial, Ethernet), and vice versa.

"Min. block size (bytes)", "Min. block usage (%)" - to get bigger communication blocks, increase minimum block size, or decrease a minimum percentage of actually used block space.

"Default" - set all options to default. Applies to current tab only.

Wait time

Wait time may be useful if more than one device access data from a single plc (i.e. two HitOPC servers, or a single HitOPC and an operator panel). Wait time applies to Ethernet UDP communication only.

Wait time is specified as a time interval, in milliseconds, in which HitOPC will send no communication requests, despite number of tags and update time requested by OPC client.

An example: if OPC client requests a single location with the update time of 1000ms, wait time less than 1000ms will not affect performance anyhow. But if requested number of locations is a few thousands, communication needs more than full bandwidth, so setting wait time to i.e. 200ms will increase the communication cycle, but will also allow access for other data servers.

"Messages before wait" - a number of consequent messages before applying wait time.

"Wait time (ms)" - duration of inactivity period.

"Retries on BUSY" - allowed number of communication retries, when the answer was BUSY. When number of retries is exceeded, communication continues with the next communication block.

If a block is not updated in one communication cycle, property "Last communication cycle" will show less than 100% updated tags. This is only a kind of early warning, because the relevant information is tag quality - if tag quality is good, skipping a few communication cycles doesn't affect system performance.

Usually, 2 or 3 retries ensure 100% update in most situations. Zero means no retries.

"Default" - set all options to default. Applies to the current tab only.

Advanced

"Disable binary mode on serial" - force serial communication to use ASCII protocol.

"Quality independent SyncRead" - if checked, OPC call SyncIO::Read always returns GOOD tag quality. Useful for some OPC clients (Wizcon).

"Forced OnChange value updates" option forces callbacks to OPC client for all items, no mater if their value is changed since last callback. Useful for some OPC clients (RSView).

"Show serial communication" - displays and logs all serial communication messages. It may be useful for testing and debuging.

"Create log file" - if checked, message log will be written to the file "HitOPC.log", created in the HitOPC directory ("C:\Program Files\Hitachi OPC Server\" is default). Log file may be useful to trace any OPC related problem.

"Slow down visual update rate" - on some very slow PCs, this option will give more CPU time to the main application (SCADA), loosing visual update speed of HitOPC (actual data exchange performance is not affected).

"Local UDP port same as PLC" - by default, HitOPC on PC side use the first available UDP port number, auto-assigned by Windows (not neccesary the same as PLC). Because the number may be different each time PC restarts, it may cause troubles with a firewall. Using this option, UDP port is forced to be the same as on the PLC side, so user is able to set any desired value - but should take care not to use the same port in an other application.

"Default" - set all options to default. Applies to the current tab only.

Using OPC Server

To access a PLC location, Hitachi OPC Server follows standard Hitachi notation:

<PLC name>.<memory code><address>

Integer type is unsigned by default. To access location as signed, enter:

<PLC name>.<memory code><address>S

To read a string, modified syntax applies:

<PLC name>.<memory code><address>.ASC.<size>

To read an array, syntax is:

<PLC name>.<memory code><address>.ARR.<count>

Where <*size*> is number of characters, and <*count*> is number of array elements. Size may be odd or even. Double word area should be avoided. Suffix is not case sensitive. Size does not apply to task code limitations, so it may be as big as it needs.

Examples:

PLC1.R7E7..... read bit from R area
PLC1.WR0..... read word from R area
PLC1.WR0S ..... read word and return as signed integer
PLC1.WR0.ASC.24 ..... read 24 characters starting from WR0
PLC1.WR0.ARR.12 ..... read 12 16-bit words (24 bytes) starting from WR0

Memory codes and address spaces are:

X 0-H4FF95
WX.....0-H4FF9
DX.....0-H4FF8
Y 0-H4FF95
WY 0-H4FF9
DY.....0-H4FF8
R 0-H7FF
WR.....0-HFFFF
DR.....0-HFFFE
M.....0-H7FFFF
WM 0-H7FFF
DM 0-HFFFE
WN.....0-H1FFFF
DN.....0-H1FFFE
L.....0-HFFFF
DL 0-HFFFE
DIF 0-H1FF
DFN 0-H1FF
CL 0-H9FF
TC 0-H9FF
TMCNT 0-H1FF
EX.....0-H5A7FF
WEX.....0-H5A7F
EY 0-H5A7FF
WEY.....0-H5A7F

Actually available memory depends on CPU. When reading a non-existing location, all other locations may also get bad quality.

Local monitor

Local monitor is tool which may be used to monitor PLC variables independently of OPC client. List of monitored variables is cleared each time OPC server restarts.

Tag quality

Tag quality is an attribute given to each monitored location. It may be used by OPC client to indicate if displayed data is regularly updated.

Hitachi OPC Server sets UNCERTAIN and then BAD quality if no communication cycle is completed within defined time interval. Setting BAD and UNCERTAIN quality may be disabled in the configuration window.

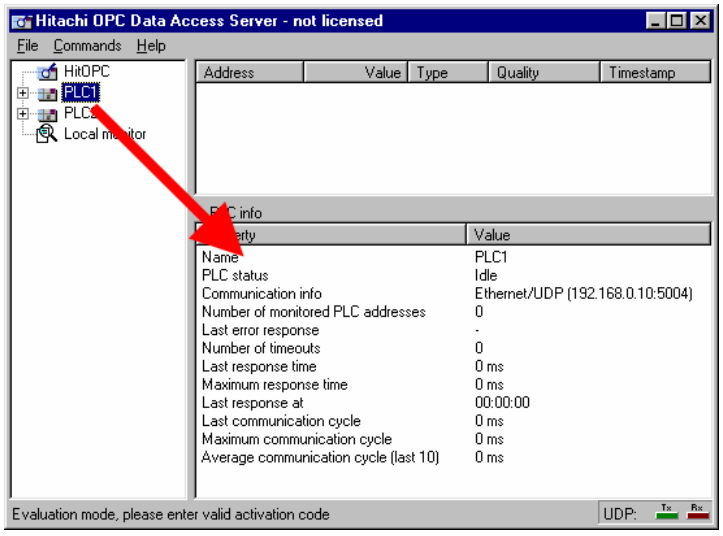
When monitoring an unassigned PLC location (i.e. non-existing I/O module), Hitachi OPC sets quality to CONFIG_ERROR. This quality will be assigned to all variables in same communication block, so the user should find out which one actually causes the error.

PLC and server properties

HitOPC server and each configured PLC have a list of predefined properties, which show current status and performance values.

To show HitOPC properties, click HitOPC icon in the left window. To show PLC properties, click PLC icon.

Properties are shown in the right bottom window.



"Communication status" may be "idle", "connected" or "communication error". "Idle" means no communication is initiated (no OPC clients connected to server and local monitor list is empty).

"Communication info" shows configured communication parameters.

"Last error response" shows last error code received from PLC (if any).

"Last communication cycle" indicates time necessary to complete all read/write requests for the selected PLC. If more PLCs share the same communication port, this value is a sum of those cycle times. "100% updated" means each communication block is successfully read, no errors detected. Value lover than 100% indicate there were communication errors, some blocks are not updated in the current cycle, but will be requested again in the next cycle, so tag quality is not yet compromised. If number of unsuccessful cycles become too large, tag quality of related variables will change from "GOOD" to "UNCERTAIN", and then finally to "BAD".

"Maximum communication cycle" is maximum encountered time from server start, or from the last reset. To reset maximum time, use Commands/Reset maximum times.

"Average communication cycle" is calculated among last 10 communication cycles.

Virtual tags

OPC server properties and PLC properties are visible to SCADA system as virtual tags. Tags are "virtual" because they represent no physical PLC locations (as all other tags), but OPC server internal parameters. Virtual tags are located in sys directories, and may be used by SCADA system the same way as any other tags.

Using virtual tags, SCADA designer is capable of creating status screens, very usable for tracing communication problems.

All virtual tags are read-only, writing is not allowed.

OPC virtual tags

ServerStartedAtDate	string	"dd.mm.yyyy", date/time when server is started
ServerStartedAtTime	string	"hh:mm:ss"
ServerUptime	string	"[dd days,]hh:mm:ss", time since server started
LicenseType	string	"not licensed", "small", "medium", "unlimited"
LicenseStatus	long	0 - ok, 1 - evaluation time (tag limit exceeded), 2 - error (evaluation time expired)
TagLimit	long	10, 100, 1000, 999999999
MonitoredLocations	long	Total number of monitored locations (all PLC's)
ClientsConnected	long	Number of connected OPC clients

PLC virtual tags

Name	string	PLC name (as defined by OPC configuration)
ComStatus	long	0 - idle, 1 - connected, 2 - communication error
ComInfo	string	"Serial, Com1, 19200, ASCII"
ComIPAddress	string	"192.168.0.1", IP address of connected PLC
MonitoredLocations	long	Total number of monitored PLC locations
LastErrorCode	long	Last PLC error response code (if any)
LastErrorAtDate	string	"dd.mm.yyyy", date/time of last error response
LastErrorAtTime	string	"hh:mm:ss"
NumberOfTimeouts	long	Total number of timeout errors encountered
LastResponseTime	long	Last PLC response time in milliseconds
LastResponseAtDate	string	"dd.mm.yyyy", date/time of last valid response
LastResponseAtTime	string	"hh:mm:ss"
MaxResponseTime	long	Maximum PLC response time in milliseconds
MaxResponseAtDate	string	"dd.mm.yyyy", date/time when maximum is reached

MaxResponseAtTime	string	"hh:mm:ss"
LastComCycle	long	Last communication cycle in milliseconds
LastComCyclePercent	long	0..100%, percent of updated blocks
MaxComCycle	long	Maximum communication cycle in milliseconds
MaxComCyclePercent	long	0..100%, percent of updated blocks
AverageComCycle	long	Average of last 10 communication cycles

Date and time format is set according to regional settings.

Performance

Writing to PLC has higher priority than reading, so frequent writing may slow down reading. No meter how frequent writing is, read cycle will always be completed.

In a local Ethernet network, Hitachi OPC server loaded with 1000 variables should attain refresh cycle of about 0.5-1s. This may vary according to numerous reasons, so this is a solely informational value.

Performance of the serial communication mainly depends on the selected options. As a rough estimate, baud rate of 38400 bps in binary mode with 1000 variables should attain refresh cycle of about 2-2.5s.

Automation interface

To use the Hitachi OPC Server as an automation interface (i.e. for applications written in Microsoft Visual Basic), an automation wrapper DLL is needed. Hitachi OPC server include no such DLL, but any standard wrapper may be used. For more information please contact the OPC Foundation.

Technical Specifications

OPC Server ID:	HitachiOPC.DA2
Supported OPC versions:	1.0, 1.0A and 2.0
Supported Hitachi CPUs:	H-250 / 252 / 302 / 702 / 1002 / 2002 / 4010, Micro-EH, EH150, EHV
Used task codes:	A0h, A4h and A5h (non-occupying task codes)
Communication protocol:	ASCII or binary, autoselectable
Connection options:	Serial, Ethernet/TCP, Ethernet/UDP
Client data change interval:	20ms